COMPLETE URINALYSIS PANEL

INTERPRETATION GUIDE

Scroll down or click on the following parameters to quickly access content

A Complete Urinalysis is threefold:

- *Physical exam*

Color

Clarity - Turbidity

Urine specific gravity

- *Chemical exam*

pH

PRO (protein)

GLU (glucose)

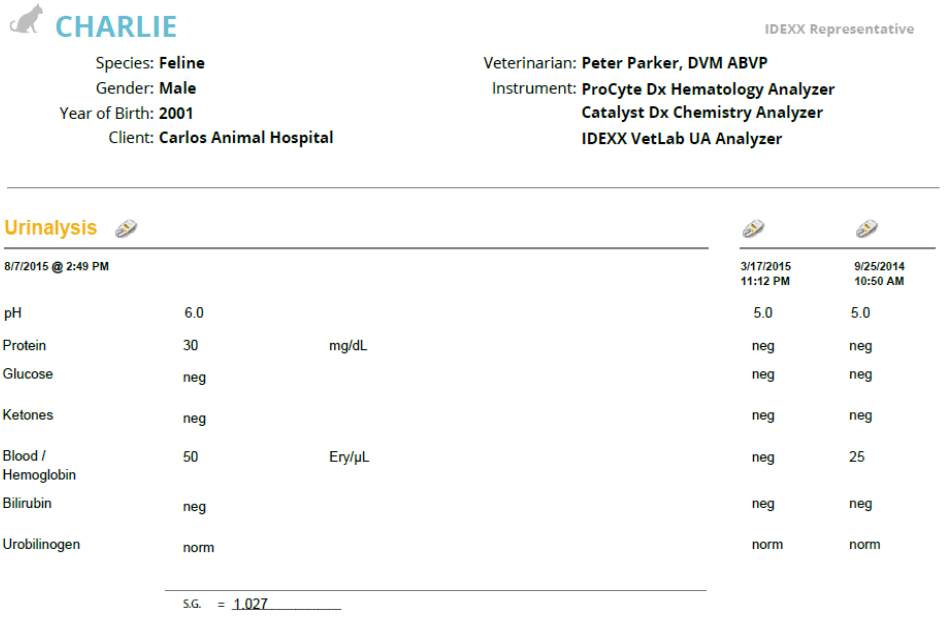
KET (ketones)

UBG (urobilinogen)

BIL (bilirubin)

Blood

LEU



CHARLIE

IDEXX Representative

Species: **Feline**
Gender: **Male**
Year of Birth: **2001**
Client: **Carlos Animal Hospital**

Veterinarian: **Peter Parker, DVM ABVP**
Instrument: **ProCyte Dx Hematology Analyzer**
Catalyst Dx Chemistry Analyzer
IDEXX VetLab UA Analyzer

Urinalysis

8/7/2015 @ 2:49 PM			3/17/2015 11:12 PM	9/25/2014 10:50 AM
pH	6.0		5.0	5.0
Protein	30	mg/dL	neg	neg
Glucose	neg		neg	neg
Ketones	neg		neg	neg
Blood / Hemoglobin	50	Ery/µL	neg	25
Bilirubin	neg		neg	neg
Urobilinogen	norm		norm	norm

S.G. = 1.027

- *Sediment exam* (see urine sediment guide)

Cells, bacteria, casts, crystals and miscellaneous elements

Urine Clarity

Description

- In most animals, normal urine is clear to slightly cloudy.
- In horses, normal urine is cloudy due to the presence of calcium carbonate crystals and mucus.

Values Below Reference Range

Common Causes
In an animal that typically shows cloudy urine, a clear urine would suggest absence of crystalluria.

Values Above Reference Range

Common Causes
Excessively cloudy urine can be the result of high numbers of crystals, leukocytes, erythrocytes, bacteria, mucus, casts, lipids, or possibly sperm.

Other Laboratory Tests
Microscopic examination of the urine sediment is advised.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

DiBartola SP. Clinical approach and laboratory evaluation of renal disease. In *Textbook of Veterinary Internal Medicine.* Ettinger SJ, Feldman EC, eds. Philadelphia, Pa: WB Saunders Company; 1995.

Duncan JR, Prasse KW, Mahaffey EA. *Veterinary Laboratory Medicine.* Ames, Iowa: Iowa State University Press; 1994.

Urine Specific Gravity

Description

- Specific gravity is a reflection of solute concentration.
- It should be determined by refractometry as dipsticks are inaccurate.
- Assuming normal hydration status and no treatments that alter water resorption by the kidneys, expected specific gravity results are:
    - Dogs: 1.015–1.045
    - Cats: 1.035–1.060
    - Horses: 1.020–1.050
- The amount of other substances in urine should be interpreted in consideration of the specific gravity.

Values Below Reference Range

Common Causes

- Hyposthenuria indicates that the kidney can dilute the glomerular filtrate, but cannot concentrate it.
- Hyposthenuria can be indicated by:
    - Lack of ADH (primary diabetes insipidus)
    - Resistance to ADH (renal diabetes insipidus)
    - Increased water consumption (primary polydipsia)
    - Lack of medullary concentrating ability
- Isosthenuria indicates that the kidney can neither dilute nor concentrate the glomerular filtrate.
- Specific gravity above isosthenuria but below normal specific gravity reflects inadequate renal tubular function.

Related Findings

- Low specific gravity can be caused by diuretics, glucocorticoids and fluid therapy.
- It is important to check specific gravity before administration of any of these treatments.

Other Laboratory Tests

- Use of dipsticks to evaluate urine specific gravity is not recommended.
- Further testing is indicated in a patient with persistently hyposthenuric or isosthenuric urine.
- These tests should include biochemistry profile, CBC, serum T_4 and urinalysis to start.
- Urine concentration tests may also be indicated.

Values Above Reference Range

Common Causes

- Elevated specific gravity must be interpreted in light of BUN, creatinine concentrations and hydration status.
- High specific gravity does not rule out the presence of diseases associated with PU/PD, such as:
    - Hepatic insufficiency
    - Hyperadrenocorticism
    - Hyperthyroidism

Related Findings
Very concentrated urine is often associated with dehydration.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

DiBartola SP. Clinical approach and laboratory evaluation of renal disease. In *Textbook of Veterinary Internal Medicine.* Ettinger SJ, Feldman EC, eds. Philadelphia, Pa: WB Saunders Company; 1995.

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Stockham SL and Scott MA. *Fundamentals of Veterinary Clinical Pathology*, 2nd ed. Ames, Iowa: Blackwell Publishing, John Wiley & Sons, Inc.; 2008.

Urine pH

Description

- Urine pH is a measure of the hydrogen ion concentration in urine.
- Urine pH is determined by the kidney's ability to regulate hydrogen ion and bicarbonate concentrations within the blood.
- In fresh urine samples from healthy dogs and cats, the pH range is 5.5–8.5. This parameter is specific for the detection of hydronium ions, with the pH being the negative common logarithm of the hydronium ion concentration. The test pad contains the indicators methyl red, phenolphthalein and bromthymol blue.
- Reactive components per cm^2: bromthymol blue 13.9 µg, methyl red 1.2 µg, phenolphthalein 8.6 µg

Values Below Reference Range

Common Causes

- Respiratory acidosis
- Metabolic acidosis
- High protein diet
- Vomiting with chloride depletion
- Severe diarrhea
- Fever
- Starvation
- Prolonged exercise
- Urinary acidifiers

Values Above Reference Range

Common Causes

- Recent meal
- Metabolic alkalosis
- Respiratory alkalosis
- Bacterial infection
- Renal tubular acidosis
- Purely vegetable diet

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods*. Willard MD, Tvedten H, and Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

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Urine Leukocytes

Description

- The reaction detects the presence of esterases that occur in granulocytes. These enzymes cleave an indoxyl ester, and the indoxyl reacts with a diazonium salt to produce a violet dye. Both intact and lysed leukocytes are detected. The reaction is not affected by bacteria, trichomonads or erythrocytes present in the urine. Formaldehyde (stabilizer) and medication with antibiotics containing imipenem, meropenem or clavulanic acid may cause false-positive reactions. If the urine specimen is strongly colored (for example, due to the presence of bilirubin or nitrofurantoin), the reaction color may be masked. Urinary protein excretion in excess of 500 mg/dL and urinary glucose excretion in excess of 2 g/dL may diminish the intensity of the reaction color, as can medication with antibiotics containing cephalexin or gentamicin if administered in high daily doses.

  NOTE: The leukocyte parameter should not be used to test urine from cats. All test results for dogs should be confirmed with microscopy due to a high number of false-negatives.

- Evaluation of urine WBC is part of the sediment exam.
- Numbers of WBC are reported per high power field (hpf).
- Normal values are dependent on method of urine collection. Normal values are 0–8/hpf for voided sample, 0–5/hpf for catheterized sample and 0–3/hpf for cystocentesis sample.
- When excessive numbers of WBC are present, it indicates inflammation somewhere in the urinary tract.
- Reactive components per cm^2: indoxyl ester 15.5 µg, methoxy-morpholinobenzene diazonium salt 5.5 µg

Values Below Reference Range

Common Causes

- Normal
  - The normal range includes zero.
- Artifact due to lysis
  - Alkaline urine, dilute urine or prolonged exposure to room temperature will cause WBC lysis.

Values Above Reference Range

Common Causes

- Urinary tract infection (kidney or urinary bladder)
  - Patients with diabetes mellitus or hyperadrenocorticism may have urinary tract infections but not show pyuria.
- Genital tract contamination (voided or catheterized samples)
- Calculi
- Neoplasia

Related Findings

- Signs of urinary tract infection
  - Dysuria, pollakiuria, foul-smelling urine, hematuria
- Signs of pyelonephritis
  - Fever, depression, anorexia, polydipsia, polyuria
- Casts
  - WBC casts are almost pathognomonic for pyelonephritis.

Other Laboratory Tests

- Urine culture and sensitivity
- Radiographs, contrast studies and ultrasound

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

DiBartola SP. Clinical approach and laboratory evaluation of renal disease. In *Textbook of Veterinary Internal Medicine*. Ettinger SJ, Feldman EC, eds. Philadelphia, Pa: WB Saunders Company; 1995.

Duncan JR, Prasse KW, Mahaffey EA. *Veterinary Laboratory Medicine.* Ames, Iowa: Iowa State University Press; 1994.

Urine Protein

Description

- Trace amounts of protein (50 mg/dL or less) can normally be found in urine.
- Dipsticks show a negative, trace, 1+–3+ reaction that correlates to 30, 100, or 500 mg/dL protein.
- This test is based on the principle that proteins bind to an acid-base indicator dye. The test is particularly sensitive to albumin, but may react with hemoglobin and globulins. Quinine, quinidine, chloroquine and tolbutamide do not affect the test, nor does a high pH (up to pH 9). False-positive results may occur after infusion of hemoglobin-based oxygen-carrying solutions (blood substitute), or if the urine specimen collection vessel contains residues of disinfectants based on quaternary ammonium compounds or chlorhexidine.
- Expected protein results in dogs can be negative–1+, with trace and 1+ reactions found in more concentrated samples.
- Urine protein precipitation (sulfosalicylic acid, nitric acid) methods are also graded 1+–4+ and may detect proteins not appreciated by the dipsticks.
- Reactive components per cm^2: tetrachlorophenoltetrabromosulfophthalein 13.9 µg

Values Below Reference Range

Common Causes
Values below reference range are not clinically significant.

Values Above Reference Range

Common Causes
Proteinuria can be classified according to source as follows:

- Inflammation
    - Involvement of upper or lower urinary tract
    - Reflected in an active urinary sediment (leukocytes, possibly bacteria)
- Hemorrhage
    - Positive for urine occult blood and possibility of sediment with erythrocytes
- Renal glomerular disease
    - Glomerulonephritis
    - Amyloidosis
- Prerenal
    - Occasional mild proteinuria may be secondary to increased glomerular permeability (shock, heart disease, fever, CNS disease, increased physical exercise).
    - Overflow proteinuria [high concentrations of low molecular weight proteins (myoglobin, Bence Jones protein)] in the peripheral blood that can be filtered and fail to be resorbed totally by the tubules.

Related Findings
Urine specific gravity must be taken into account when interpreting proteinuria.

Other Laboratory Tests

- Urine protein:urine creatinine ratio is used to determine if proteinuria is significant.
- Urine protein:urine creatinine ratio can replace the 24 hour urine collection.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

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Urine Glucose

Description

- Glucose is not normally found in the urine of dogs and cats.
- The glucose present in the glomerular filtrate is almost completely reabsorbed in the proximal tubules.
- The determination of glucose is based on the specific glucose-oxidase/peroxidase reaction. This test is independent of pH and specific gravity of the urine and is not affected by the presence of ketone bodies. The effect of ascorbic acid has been largely eliminated, such that false negatives are unlikely to occur at glucose concentrations of 100 mg/dL (5.5 mmol/L) and above.
- Reactive components per cm^2: tetramethylbenzidine 103.5 µg, GOD 6 U, POD 35 U

Values Below Reference Range

Common Causes
Not applicable. Glucose is not present normally in urine.

Values Above Reference Range

Common Causes

- Glucosuria occurs when blood glucose exceeds the renal threshold.
    - Diabetes mellitus
    - Stress or excitement (cats)
    - Infusion of fluid rich in dextrose
    - Occasionally in hyperadrenocorticism, pheochromocytoma
- Renal threshold is reached in dogs when blood glucose is >180 mg/dL and in cats when blood glucose is >300 mg/dL.
- Glucosuria also occurs when there is abnormal proximal tubular function.
    - Acute renal failure
    - Fanconi's syndrome
    - Primary glucosuria
    - Secondary to aminoglycoside toxicity
    - Rarely in familial renal disease

Other Laboratory Tests

- Analytical methods include glucose oxidase method (urine dipstick, paper test strip) and test for reducing substances (Clinitest®).
    - Clinitest® is not specific for glucose and will reflect lactose, fructose, penicillins, salicylates, few of the cephalosporins, ascorbic acid, sulfonamides and radiographic contrast media.
- Follow up tests for true glucosuria should include blood glucose, BUN, and creatinine.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

DiBartola SP. Clinical approach and laboratory evaluation of renal disease. In *Textbook of Veterinary Internal Medicine.* Ettinger SJ, Feldman EC, eds. Philadelphia, Pa: WB Saunders Company; 1995.

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Urine Ketones

Description

- Ketones, such as beta-hydroxybutyrate, acetoacetate and acetone, are produced by lipolysis and are filtered by the glomerulus.
- Normally, ketones are completely resorbed by the proximal tubules.
- This test is based on the reaction of nitroprusside with acetoacetic acid and acetone. This test does not detect beta-hydroxybutyric acid. Captopril, mesna (2-mercaptoethanesulfonic acid sodium salt) and other substances containing sulfhydryl groups may produce false-positive results.
- Reactive components per cm^2: nitroprusside sodium 157.2 µg, glycine 4.2 mg

Values Below Reference Range

Common Causes
Urine should be negative for ketones.

Values Above Reference Range

Common Causes

- Diabetic ketoacidosis
- Prolonged fasting
- Starvation
- Low carbohydrate diet
- Glycogen storage disease
- Persistent fever
- Persistent hypoglycemia

Related Findings
Ketonuria

- Test pad on urine dipstick or tablets (Acetest®) detect acetoacetate and acetone; but, they do not detect beta-hydroxybutyrate. Beta-hydroxybutyrate is responsible for producing acidosis.
- The severity of ketoacidosis cannot be correlated with the degree of ketonuria. The test pads or tablets employ the nitroprusside reaction.
- Ketonuria is present before ketonemia can be detected.

Other Laboratory Tests
Blood and Urine glucose

- If ketonuria is present with glucosuria and hyperglycemia, diabetes mellitus is diagnosed. Further tests include electrolytes, phosphorus, total CO_2, and blood gases.
- If ketonuria is present without glucosuria, excessive lipid metabolism is likely, especially in anorexic animals.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods*. Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

DiBartola SP. Clinical approach and laboratory evaluation of renal disease. In *Textbook of Veterinary Internal Medicine*. Ettinger SJ, Feldman EC, eds. Philadelphia: W.B. Saunders Company, 1995

Duncan JR, Prasse KW, Mahaffey EA. *Veterinary Laboratory Medicine*. Ames, Iowa: Iowa State University Press; 1994.

Urine Urobilinogen

Description

- Intestinal bacteria convert conjugated bilirubin to urobilinogen.
- Most is excreted in the feces. A small amount is delivered back to the liver via the portal system where the urobilinogen is then removed by the liver or excreted into the urine.
- A fresh sample is necessary as urobilinogen can be catabolized into urobilin while standing within the bladder. Normal values are 0.1–1.0 Ehrlich units. The correlation between elevated urine urobilinogen and liver disease in animals is poor.
- A stable diazonium salt reacts almost immediately with urobilinogen to give a red azo dye. No discoloration of the test pad or colors lighter than that shown for 1 mg/dL (17 µmol/L) constitute a normal finding. The test is specific for urobilinogen and is not susceptible to the interfering factors known to affect Ehrlich's test. Larger amounts of bilirubin produce momentary yellow coloration of the test pad that may turn green to blue after about 60 seconds.
- Expected results range between 0.2–1.0 mg/dL or normal to 1.0 mg/dL on urine strips.
- Reactive components per cm^2: methoxybenzene diazonium salt 67.7 µg

Values Below Reference Range

Common Causes

- Reagent strips are semiquantitative but cannot detect the absence of urobilinogen.
- Urobilinogen is unstable while in the bladder; many normal animals have no detectable urobilinogen.
    - True absence of urobilinogen would indicate an obstructed bile duct.

Values Above Reference Range

Common Causes

- Hemolytic disease
- Liver disease
    - There is a poor correlation between high urine urobilinogen and liver disease in animals.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald, GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

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Urine Bilirubin

Description

- Conjugated bilirubin will readily travel through the glomerulus into the filtrate. It is not absorbed by the tubules, and therefore it passes into the urine.
- Unconjugated bilirubin is bound to albumin and will not pass through the glomerulus.
- Dogs have a low renal threshold for bilirubin; trace amounts may be found in very concentrated urine, especially in male dogs.
- Bilirubin in urine is ultraviolet-light sensitive and delay in performing urinalysis may cause false-negative results. Standing at room temperature exposed to air can also cause a false-negative result.
- The test for bilirubin is based on the coupling of bilirubin with a diazonium salt to produce a color change. Even the slightest pink coloration constitutes a positive result. Large quantities of ascorbic acid can lead to low or false-negative results for bilirubin.
- Urine discoloration may interfere with an accurate reading of the test strip.
- Expected bilirubin results in dogs can be negative to 1+, with trace and 1+ reactions found in more concentrated samples.
- Reactive components per cm^2: Bilirubin: dichlorobenzene diazonium salt 16.7 µg

Values Below Reference Range

Common Causes
Not applicable. Zero bilirubin in urine is clinically not significant.

Values Above Reference Range

Common Causes

- In dogs (especially male dogs), trace amounts of bilirubin may be seen in very concentrated urine.
- Any bilirubinuria in cats is significant.
- Bilirubinuria usually precedes bilirubinemia.
    - May be present when serum bilirubin concentration is within normal limits.
- Intrahepatic or extrahepatic biliary obstruction with subsequent regurgitation of conjugated bilirubin into the blood.
- Intravascular hemolysis and hemoglobinuria
    - Conjugated bilirubin is increased and readily passes into glomerular filtrate.
    - Renal tubular cells can form conjugated bilirubin from absorbed hemoglobin.
- Fever or starvation

Related Findings
Elevated liver enzymes and increased serum bilirubin supports hepatic disease, while regenerative anemia with spherocytes supports hemolytic disease.

Other Laboratory Tests

- If bilirubinuria is evident, follow-up tests include serum bilirubin, alanine aminotransferase (ALT), alkaline phosphatase, and CBC.
- If CBC indicates anemia, reticulocyte count is indicated.

References

Barsanti JA, Lees GE, Willard MD, Green RA. Urinary disorders. In *Small Animal Clinical Diagnosis by Laboratory Methods.* Willard MD, Tvedten H, Turnwald GH, eds. Philadelphia, Pa: WB Saunders Company; 1999.

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Urine Blood

Description

- Hemoglobin and myoglobin catalyze the oxidation of the indicator by an organic hydroperoxide contained in the test pad. The values appearing on the report refer to intact erythrocytes, or, when free hemoglobin is present, the approximate density of RBCs that might have contributed a similar hemoglobin concentration. In other words, the value of 50 RBCs/µL also applies to hemoglobin for 50 RBCs/µL. Separate color scales for erythrocytes and hemoglobin are given on the label of the test strip container.
- Individual to closely packed green dots on the yellow test pad are indicative of intact erythrocytes.
- Hemoglobin or hemolyzed erythrocytes and myoglobin are indicated by a uniform green coloration of the test pad.
- Concentrations of 20–30 RBCs/µL and above lead to values that are higher than the corresponding concentrations given for intact erythrocytes. Ascorbic acid has virtually no effect on the test.
- Reactive components per cm^2: tetramethylbenzidine 52.8 µg, dimethyldihydroperoxyhexane 297.2 µg